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Complete Specification entitled (54) PROCESS AND DEVICE FOR TEMPERATURE CONTROL IN MOULDS FOR PLASTIC STUFFS.

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Class

Related Art (56)

The following statement is a full description of this invention, including the best method of performing it known to us :

22503/72—
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It is known that in moulding plastic stuffs the moulds are submitted only to cooling. This fact is the cause of inconveniencies inasmuch as the injected stuff, when forwarding within the mould, progressively cools thus diminishing in fluidity. There is consequently the necessity to inject the plastic stuff under a higher pressure in order to obtain an adequate speed of filling, and therefore using a correspondently high capacity machinery in view of compensating the pression drop caused by the fluidity reduction, so as to require a force of injection which repels onto the capacity itself of the machanical and/or hydraulic organs used to close the moulds.

This invention concerns a process and a device for controlling the working temperature of the moulds in view to avoid the aforesaid inconveniencies. Said process consists of heating the moulds by a whatever means, by initiating said heating at the beginning of every moulding cycle, that is to say as said moulds are still open, by maintaining them hot till they are closed, in order to put into effect a new working cycle, and till the injection step is initiated, so as to facilitate the inlet of the plastic stuff without influencing its fluidity, and then energically cooling the moulds during and after the injection step by using an appropriate cooling means under controlled temperature.

Heating and cooling are preferably affected respectively by steam and a fluid cooled in turn by an appropriate cooling device in condition to take away with energy and rapidity the heat just introduced into the moulds, together with that

one the plastic stuff in view to accelerate harding of the article.

The object of the invention is hereinafter described in more details in an example of embodiment and in connection with the attached drawings, of which:

- Figure 1 is a schema of a device for the control of the mould temperature;
- Figures 2 and 3 show respectively in cross cut and in plane views a mould to be used;
- Figure 4 represents still in cross cut view another type of utilisable mould.

Reverting to those Figures, by 1 and 2 there are designated the two halves of a mould in closed position, said mould halves being provided with incorporated channels for the passage of a fluid. The inlet of said channels is fed respectively by inlet conducts 3 and 4 derivating from a unique leading means 5, while the outlets of the channels within the mould halves are connected respectively to the conducts 6 and 7 also derivating from a unique leading means 8.

To leading means 5 there are connected two conducts 9 and 10, the first one of which being connected to a conduct for the cooled fluid and intercepted by an electrovalve 12, while the second of said conducts is connected to a steam conduct 13 intercepted by an electrovalve 14.

The leading means 8 is intercepted by a deflecting electrovalve 15 so that it may be alternatively set into comunication with an outlet conduct 16 for the cooling fluid flowing from the moulds, or with a conduct 17 arriving from

an accumulator of condensed steam also flowing from said moulds.

The fluid discharging into tank 19 can be sucked by a pumping device 20 and conveyed to a cooling apparatus 21 and from the last to a conduct 11, thus constituting a closed circuit.

In the same manner, the condensed steam of accumulator 18 can be sent by means of a pumping device 22 back to a boiler generating the steam (not shown in the figures) but forming a component of the closed hydraulic circuit.

The operation of the device is as follows:

- at the beginning of each one moulding cycle, that is to say when the mould is still open, after the article of the proceding working cycle has been discharged therefrom, electrovalve 12 is closed and electrovalve 14 open while electrovalve 15 is controlled so that leader 8 is put in communication with tank 18, Into the mould through conducts 5, 3 and 4, steam will thus arrive, in view to heat it to the required temperature, said steam discharging through conducts 6, 7, 8, valve 15 , conduct 17 and accumulator 18.

While in the phase of heating, the mould is closed and remains so during the injection of the plastic stuff.

During injection and when injection is completed, electrovalve 14 is closed and electrovalve 12 open, electrovalve 15 being deflected in order to establish the communication between conducting leardes 8 and 16. Cooling fluid is thus let to flow into the cooling channels incorporated within the mould halves thus cooling the last rapidly and also taking away

the heat of the plastic stuff, so that the moulded article will quickly harden. The fluid discharged into tank 19 will then be sent by pumps 20 to the cooling apparatus 21 for its cooling to the initial temperature. The cooling step of the mould has a duration necessary to the solidification of the plastic stuff article. Then the mould halves are opened again, after cooling has been suspended, by opening electrovalve 12, and a new working cycle is begun, for having opened again electrovalve 14, deflected electrovalve 15 and accordingly sent new steam into the mould halves for their heating.

The moulds used in this process, for having to operate at much lower pressures, can be made lighter in respect of those till to-day in use, and they can be conceived and built so as to facilitate an accordingly act more efficient and economical distribution, in particular in uniformity, of the hot and cold fluids, so that all components are in correct way influenced.

In figures 2 and 3, both mould halves comprise respectively two internal plates 23, 23' provided with the necessary shapes to generate the moulding recesses, presenting further at their rear portion plane and arched surfaces with which exactly comply the surfaces of two rear plates 24, 24', respectively. Every one of said plates 24 and 24' shows at the surface of contacting with the respective plates 23 or 23', a channelling 25, respectively 25', which extends at least on the whole surface of plates 23 and 23' interesting the moulding recess.

Every channelling 25 or 25' is continuous and constituted

by concentric circles set near one another, said circles connected in succession one another through radial connectors, as shown in figure 3. Channelling initiates as a central inlet conduct 3, 4, respectively, and terminating at the outlet aperture 27, 27', respectively, which is connected to the exhaust leading conduct 6, 7 respectively. So all mould surfaces, which interest the moulding recess, are subjected to the action of both the hot and cold fluids in turn, by alternatively passing through channelling 25 or 25'. Of course the form of the reported channelling is not limitative: in fact the distribution can be made differently as f.i. helicoidally, or constituted by complete concentric circles or rings, traversed by radial or other connecting means.

Behind plates 24, 24' there are applied distancing plates 28, 28' which lean against mould bearing plates 29.

In the example of embodiment in figure 4, every mould halves 1 or 2 comprises a shaped internal plate 30, 30', respectively, behind which a large chamber 31, 31' is foreseen for the passage of the hot and the cold fluids. Each one such chambers shows an inlet aperture 32, 32' in communication with the inlet conduit 3, 4, respectively, and with an outlet aperture 33, 33', respectively, in communication with the exhaust conduit 6, 7 respectively. Plates 30 and 30' can be reinforced by means of transversal ribs 34, 34' respectively in view to impede any flexion and/or deformation of the mould halves during injection.

It clearly results from the above description that the mould, when duly heated, facilitates and accelerates the step

of injection of the plastic stuff, so as to require a much minor pressure of injection as it should be in a cold mould, and that consequently the necessary capacity of the injection machinery may be accordingly reduced.

It is further clear that a fluid submitted to a controlled temperature accelerates the step of cooling and solidifying of the moulded plastic stuff article, which is the longest portion of the moulding cycle, thus enturing a considerable higher output of the machinery in the time unity.

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The claims defining the invention are as follows:

1.- A process for the control of the temperature of the moulds in manufacturing plastic stuff articles characterised in that the mould halves are heated by a hot fluid at the beginning of every moulding cycle, thus maintained during the step of closure of the mould halves and the step of injection of the already hot plastic stuff; in that the mould halves are cooled immediately at a controlled temperature as soon as injection is terminated, in that cooling is maintained till the full solidification of the plastic stuff moulded article is obtained, and in that cooling is interrupted just before the opening again of said mould halves.

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2.- A process, as claimed in claim 1, wherein heating of the moulds is provided by water steam at the appropriated temperature.

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3.- A process, as claimed in claim 1, wherein the steam outcoming from the moulds is collected into a steam condenser and sent back from the last to the steam generator. 11 JAN 1968

4.- A process, as claimed in claim 1, wherein the cooling water outcoming from the moulds is sent to a cooling apparatus wherein its temperature is brought to its initial degree.

5.- A device for actuation of the process of one of 11 JAN 1968 any/the proceding claims and comprising inlet conduits in communication with the inlet channellings provided within the mould halves and susceptible to be alternatively communicated with the hot and cold fluids, and comprising further exhaust conducts in communication with the outlet apertures of said channellings.

6.- A device, as claimed in claim 5, wherein channellings 11 JAN 1968

incorporated in each one mould halves is uniformely displayed such as to comply with all the component parts which are of interest for the moulding recess or recesses.

7.- A device, as claimed in claims 5 or 6, wherein the channelling incorporated within the mould is by a continuous channel extending by concentric circles, each one being connected to the successive of such circles or rings.

8.- A device, as claimed in claims 5 or 6, wherein the channelling is composed of a helicoidal continuous conduct.

9.- A device, as claimed in claims 5 or 6, wherein the channelling incorporated or applied to each one mould halves is composed of large passage forming chambers.

10.- A device, as claimed in claim 5 through 9, wherein the channelling is contacting with shaped plates lodged within the mould and forming the moulding recess, said plates having a relatively reduced thickness.

11.- A device as shown in the attached figures and described hereinabove.

12.-A process for controlling the temperature of moulds in the manufacture of plastic articles substantially as herein described with reference to the drawings.

13.- A process for controlling the mould temperature, in the manufacture of plastic articles, including any one of the novel steps herein disclosed.

14.- A process for controlling the mould temperature, in the manufacture of plastic articles, including any novel combination of the steps herein disclosed.

15.- A process for the manufacture of plastic articles including the steps of controlling the mould temperature substantially as defined in any one of claims 1 to 4, 12, 13 or 14

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16.- Apparatus for controlling the temperature of moulds for the manufacture of plastic articles substantially as herein described with reference to the drawings. 11 JAN 1968

17.- Apparatus for controlling the temperature of moulds for the manufacture of plastic articles having any one of the novel features herein disclosed. 11 JAN 1968

18.- Apparatus for controlling the temperature of moulds for the manufacture of plastic articles having any novel combination of the features herein disclosed. 11 JAN 1968

19.- Means for manufacturing plastic articles incorporating devices or apparatus as defined in any one of Claims 5 to 11, 16, 17 and 18. 11 JAN 1968

D A T E D this 10th day of January, 1968.

TRIULZI S.p.A.
By its Patent Attorneys:
CALLINAN AND NEWTON

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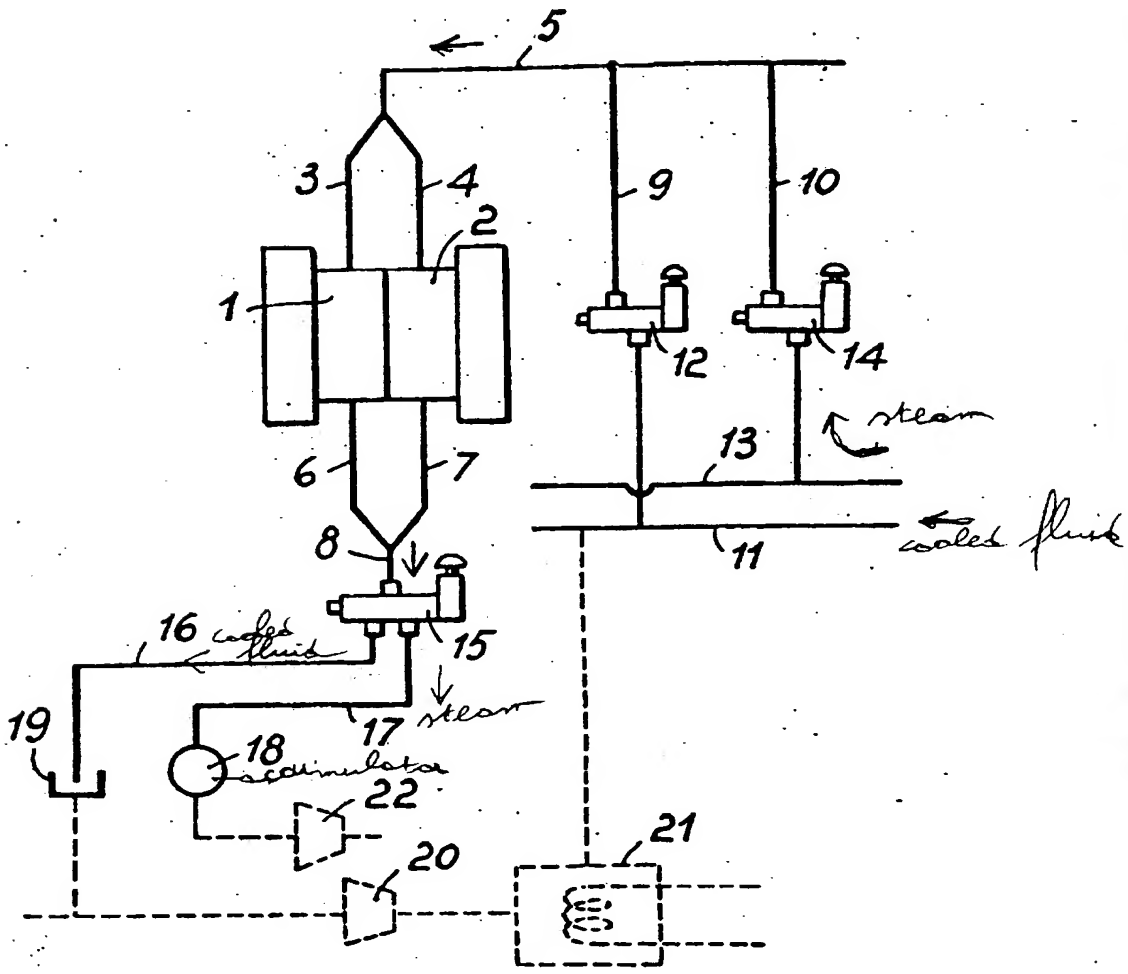

Fig. 1

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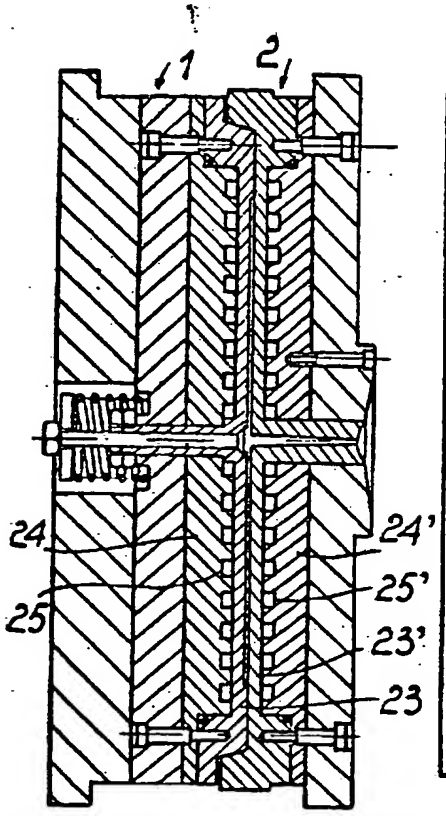

Fig. 2

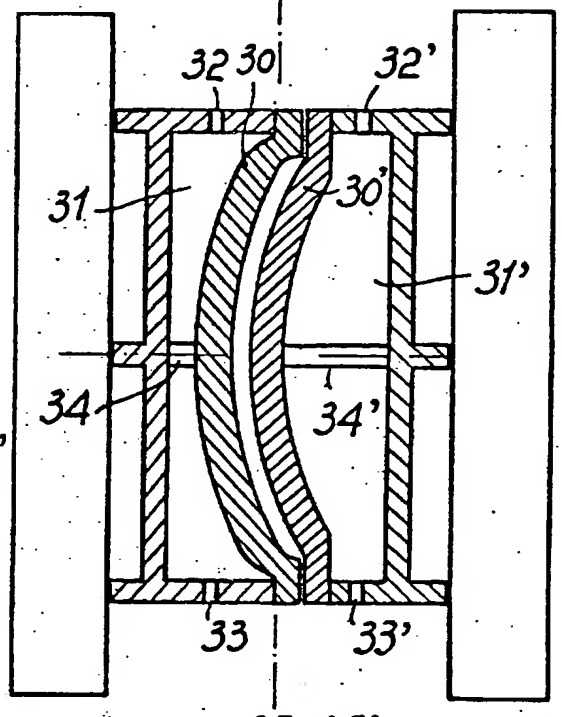

Fig. 4

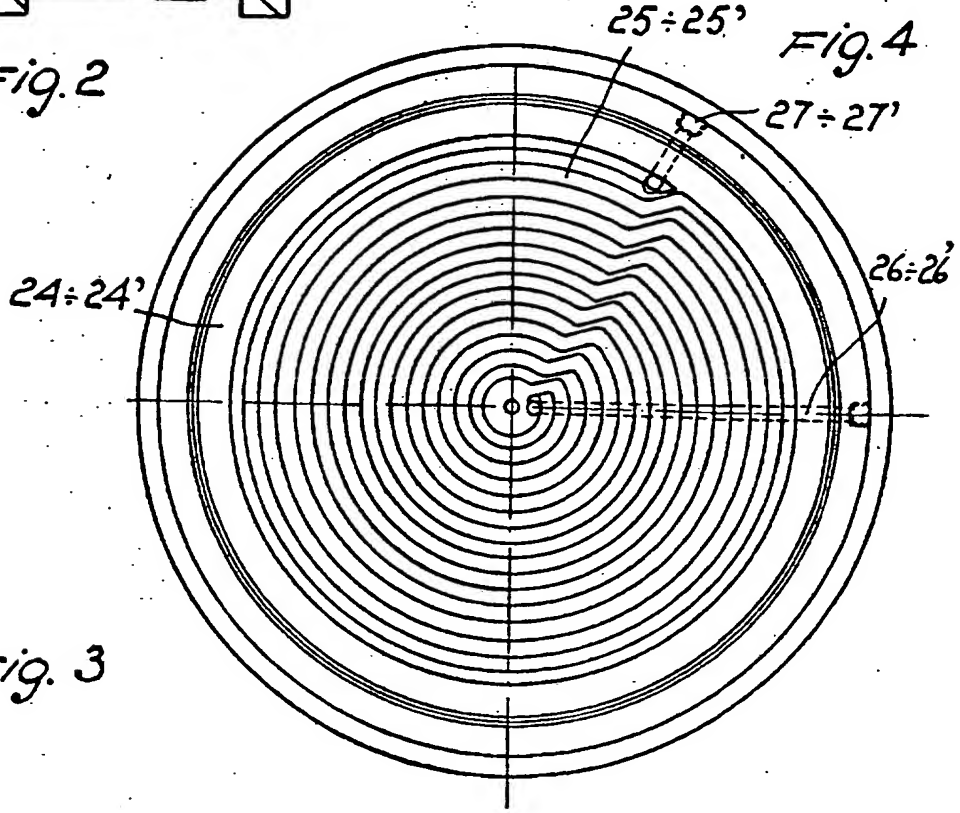

Fig. 3